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EL465688995

PTO/SB/05 (4/98)

Approved for use through 09/30/2000 OMB 0651-0032

Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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UTILITY
PATENT APPLICATION
TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No. MI22-1550

First Inventor or Application Identifier Jason E. Tripard

Title Integrated Circuit Package Separators

Express Mail Label No. EL465688995US

99/687600
10/12/00

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. * Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)

2. Specification [Total Pages 44]
(preferred arrangement set forth below)

- Descriptive title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings (if filed)
- Detailed Description
- Claim(s)
- Abstract of the Disclosure

3. Drawing(s) (35 U.S.C. 113) [Total Sheets 6]

4. Oath or Declaration [Total Pages 2]

- a. Newly executed (original or copy)
- b. Copy from a prior application (37 C.F.R. § 1.63(d))
(for continuation/divisional with Box 16 completed)
 - i. DELETION OF INVENTOR(S)
Signed statement attached deleting
inventor(s) named in the prior application,
see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

* NOTE FOR ITEMS 1 & 13 IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

ADDRESS TO: Assistant Commissioner for Patents
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5. Microfiche Computer Program (Appendix)

6. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)

- a. Computer Readable Copy
- b. Paper Copy (identical to computer copy)
- c. Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. Assignment Papers (cover sheet & document(s))

8. 37 C.F.R. § 3.73(b) Statement Power of
(when there is an assignee) Attorney

9. English Translation Document (if applicable)

10. Information Disclosure Statement (IDS)/PTO-1449 Copies of IDS
Statement (IDS)/PTO-1449 Citations

11. Preliminary Amendment

12. Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)

13. * Small Entity Statement(s) Statement filed in prior application
(PTO/SB/09-12) Status still proper and desired

14. Certified Copy of Priority Document(s)
(if foreign priority is claimed)

15. Other:

16. If a CONTINUATING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:
 Continuation Divisional Continuation-in-part (CIP) of prior application No. 09/533,058

Prior application information: Examiner

S. Choi

Group / Art Unit 3724

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

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| Name | Wells, St. John, Roberts, Gregory & Matkin, P.S. | | |
| Address | 601 W. First Avenue, Suite 1300 | | |
| City | Spokane | State | WA |
| Country | | Zip Code | 99201-3828 |

| | | | |
|-------------------|-----------------|----------------------------------|--------|
| Name (Print/Type) | D. Brent Kenady | Registration No (Attorney/Agent) | 40,045 |
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TOTAL AMOUNT OF PAYMENT (\$710.00)

Complete if Known

| | |
|----------------------|-------------------------|
| Application Number | Priority 09/533,058 |
| Filing Date | Priority March 22, 2000 |
| First Named Inventor | Jason E. Tripard |
| Examiner Name | Priority S. Choi |
| Group / Art Unit | Priority 3724 |
| Attorney Docket No. | MI22-1550 |

METHOD OF PAYMENT (check one)

1. The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

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FEE CALCULATION

1. BASIC FILING FEE

| Large Entity Fee Code (\$) | Small Entity Fee Code (\$) | Fee Description | Fee Paid |
|----------------------------|----------------------------|-------------------------------|----------|
| 101 | 760 | 201 380 Utility filing fee | 710.00 |
| 106 | 310 | 206 155 Design filing fee | |
| 107 | 480 | 207 240 Plant filing fee | |
| 108 | 760 | 208 380 Reissue filing fee | |
| 114 | 150 | 214 75 Provisional filing fee | |

SUBTOTAL (1) (\$710.00)

2. EXTRA CLAIM FEES

| Total Claims | Independent Claims | Multiple Dependent | Extra Claims | Fee from below | Fee Paid |
|--------------|--------------------|--------------------|--------------|----------------|----------|
| 13 | 1 | | -20** | 0 | 18.00 |
| | | | -3** | 0 | 80.00 |
| | | | | | = 0.00 |

**or number previously paid, if greater. For Reissues, see below

| Large Entity Fee Code (\$) | Small Entity Fee Code (\$) | Fee Description |
|----------------------------|----------------------------|--|
| 103 | 18 | 203 9 Claims in excess of 20 |
| 102 | 78 | 202 39 Independent claims in excess of 3 |
| 104 | 260 | 204 130 Multiple dependent claim, if not paid |
| 109 | 78 | 209 39 ** Reissue independent claims over original patent |
| 110 | 18 | 210 9 ** Reissue claims in excess of 20 and over original patent |

SUBTOTAL (2) (\$0.00)

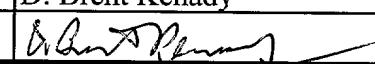
3. ADDITIONAL FEES

| Large Entity Fee Code (\$) | Small Entity Fee Code (\$) | Fee Description | Fee Paid |
|----------------------------|----------------------------|---|----------|
| 105 | 130 | 205 65 Surcharge - late filing fee or oath | 0.00 |
| 127 | 50 | 227 25 Surcharge - late provisional filing fee or cover sheet | 0.00 |
| 139 | 130 | 139 130 Non-English specification | 0.00 |
| 147 | 2,520 | 147 2,520 For filing a request for reexamination | 0.00 |
| 112 | 920* | 112 920* Requesting publication of SIR prior to Examiner action | 0.00 |
| 113 | 1,840* | 113 1,840* Requesting publication of SIR after Examiner action | 0.00 |
| 115 | 110 | 215 55 Extension for reply within first month | 0.00 |
| 116 | 380 | 216 190 Extension for reply within second month | 0.00 |
| 117 | 870 | 217 435 Extension for reply within third month | 0.00 |
| 118 | 1,360 | 218 680 Extension for reply within fourth month | 0.00 |
| 128 | 1,850 | 228 925 Extension for reply within fifth month | 0.00 |
| 119 | 300 | 219 150 Notice of Appeal | 0.00 |
| 120 | 300 | 220 150 Filing a brief in support of an appeal | 0.00 |
| 121 | 260 | 221 130 Request for oral hearing | 0.00 |
| 138 | 1,510 | 138 1,510 Petition to institute a public use proceeding | 0.00 |
| 140 | 110 | 240 55 Petition to revive - unavoidable | 0.00 |
| 141 | 1,210 | 241 605 Petition to revive - unintentional | 0.00 |
| 142 | 1,210 | 242 605 Utility issue fee (or reissue) | 0.00 |
| 143 | 430 | 243 215 Design issue fee | 0.00 |
| 144 | 580 | 244 290 Plant issue fee | 0.00 |
| 122 | 130 | 122 130 Petitions to the Commissioner | 0.00 |
| 123 | 50 | 123 50 Petitions related to provisional applications | 0.00 |
| 126 | 240 | 126 240 Submission of Information Disclosure Stmt | 0.00 |
| 581 | 40 | 581 40 Recording each patent assignment per property (times number of properties) | 0.00 |
| 146 | 760 | 246 380 Filing a submission after final rejection (37 CFR 1.129(a)) | 0.00 |
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| | | |
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| Typed or Printed Name | D. Brent Kenady | Complete (if applicable) |
| Signature |  | Reg. Number 40,045 |
| Date | 12-12-00 | Deposit Account User ID |

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1 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

2 Priority Application Serial No. 09/533,058
3 Priority Filing Date March 22, 2000
4 Inventor Jason E. Tripard
5 Assignee Micron Technology, Inc.
6 Priority Group Art Unit 3724
7 Priority Examiner S. Choi
8 Attorney's Docket No. MI22-1550
9 Title: Integrated Circuit Package Separators

7 **PRELIMINARY AMENDMENT**

8 To: Assistant Commissioner for Patents
9 Washington, D.C. 20231

10 From: D. Brent Kenady (Tel. 509-624-4276; Fax 509-838-3424)
11 Wells, St. John, Roberts, Gregory & Matkin P.S.
12 601 W. First Avenue, Suite 1300
13 Spokane, WA 99201-3828

14 **AMENDMENTS**15 **In the Specification**

16 Replace the title with --Integrated Circuit Package Separators--.

17
18 At p. 1, before the "Technical Field" section, insert

19 **--RELATED PATENT DATA**

20 This patent resulted from a divisional application of United States
21 Patent Application Serial No. 09/533,058, filed March 22, 2000, and titled
22 "Integrated Circuit Package Separators", which is a divisional application

1 of United States Patent Application Serial No. 09/176,479, which was
2 filed on October 20, 1998.--

3

4 **Amended Claims**

5 Please cancel claims 1-21 and 35-91.

REMARKS

Claims 1-21 and 35-91 are canceled, leaving claims 22-34 pending in the application. Applicant elects to prosecute the claims of Group E and requests examination of such claims.

Respectfully submitted,

Dated: 12-12-00

By: D. Brent Kenady
D. Brent Kenady
Reg. No. 40,045

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EL465688995
EL169835515

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION FOR LETTERS PATENT

* * * * *

**Integrated Circuit Package Separators, And
Methods Of Forming Integrated Circuit Packages**

* * * * *

INVENTORS

Jason E. Tripard

ATTORNEY'S DOCKET NO. MI22-975

1 Integrated Circuit Package Separators, And Methods Of Forming Integrated Circuit Packages

3 TECHNICAL FIELD

4 The invention pertains to methods of forming integrated circuit
5 packages, as well as to devices for separating integrated circuit packages.

7 | BACKGROUND OF THE INVENTION

8 Circuit constructions having integrated circuit (IC) chips bonded to
9 circuit boards (such as SIMMs and DIMMs) can be fabricated by joining
10 IC chips on a single large circuit board comprising a plurality of the
11 constructions. The circuit board can be subsequently cut to separate
12 discrete constructions from one another. The discrete constructions are
13 referred to herein as integrated circuit packages. The smaller the
14 individual circuit packages, the more likely it is for industry processing
15 to utilize the above-described method of forming the packages on a
16 single large board and subsequently cutting individual packages from the
17 board.

18 An exemplary prior art process of separating integrated circuit
19 packages is described with reference to Fig. 1. Fig. 1 illustrates a
20 board assembly 10 having a plurality of IC chips 12 (only some of which
21 are labeled) bonded thereto. Chips 12 are aligned into individual IC
22 package configurations 14 (only some of which are labeled) to form a
23 repeating pattern of integrated circuit packages 14 across the board

1 assembly 10. Dashed lines 16 are shown to illustrate the boundaries
2 between individual IC packages 14. In the shown exemplary embodiment,
3 assembly 10 comprises three separate circuit boards 11, 13 and 15. The
4 number and size of individual circuit boards can vary depending on the
5 number and size of IC packages that are ultimately to be formed.

6 Each of boards 11, 13 and 15 comprises a pair of lateral waste
7 sections 21, 23 and 25, respectively. The lateral waste sections 21, 23
8 and 25 are separated from the remainder of boards 11, 13 and 15,
9 respectively, by imaginary dashed lines 20, 22 and 24. In further
10 processing, the individual IC packages 14 are separated from one another
11 by cutting through boards 11, 13 and 15 along the regions illustrated by
12 dashed lines 16. During the cutting to separate IC packages 14 from
13 one another, boards 11, 13 and 15 are also cut along regions illustrated
14 by dashed lines 20, 22 and 24 to remove waste portions 21, 23 and 25
15 from the lateral sides of the boards, and accordingly from lateral edges
16 of the ultimately formed IC packages.

17 Orifices 19 (only some of which are labeled) are provided
18 throughout circuit boards 11, 13 and 15. Specifically, pairs of orifices 19
19 are provided in each IC package 14, and at least two orifices 19 are
20 provided in each of waste portions 21, 23 and 25.

21 Fig. 1 further illustrates an IC package separator 40 comprising a
22 cutting mechanism 42 (shown schematically as a cutting wheel, although
23 other cutting mechanisms, such as, for example, router bits or linear

1 blades, are known to persons of ordinary skill in the art), a retaining
2 table 44, and a control mechanism 45 configured to control orientation
3 of cutting wheel 42 relative to table 44. Retaining table 44 can
4 comprise, for example, an x-y table (i.e., a table horizontally adjustable
5 in x and y directions; an "X", "Y" and "Z" axis system is illustrate in
6 a lower corner of Fig. 1). Control mechanism 45 can control the x
7 and y orientation of table 44 and the z (i.e., vertical) orientation of
8 cutting mechanism 42 to precisely cut a board retained on table 44.
9 Table 44, cutting mechanism 42, and control mechanism 45 can be
10 comprised by commercially available cutting systems, such as, for example,
11 Advanced Technology Incorporated's CM101 single spindle router (or,
12 more generally, a circuit board depanelization router).

13 Fig. 1 also illustrates that table 44 comprises an upper
14 platform 46. A subplate 48 is provided over platform 46, and a stripper
15 plate 50 is provided over subplate 48. Subplate 48 comprises a plurality
16 of upwardly extending pins 60 (only some of which are labeled), and
17 stripper plate 50 comprises a number of orifices 62 configured to slide
18 over pins 60. Subplate 48 is retained on table 44 by downwardly
19 extending pins (not shown) which are aligned with and precisely received
20 within orifices (not shown) extending within platform 46 of table 44.

21 Orifices 19 of boards 11, 13 and 15 align with pins 60. In
22 operation, boards 11, 13 and 15 are slid over pins 60 until the pins
23 protrude through orifices 19. Typically, orifices 19 are only about

1 0.003 inches wider than pins 60 to insure tight alignment of boards 11,
2 13 and 15 with subplate 48. After boards 11, 13 and 15 are retained
3 on table 44 by pins 60, cutting mechanism 42 is utilized to cut along
4 the regions illustrated by dashed lines 16, 20, 22 and 24. Such cutting
5 separates discrete integrated circuit packages 14 from one another, as
6 well as from waste regions 21, 23 and 25. The separated circuit
7 packages are retained on table 44 by pins 60 extending through the
8 packages. Specifically, each of individual packages 14 comprises a pair
9 of orifices 19 and is thereby retained on table 44 by a pair of pins 60.

10 After the IC packages are separated from one another, stripper
11 plate 50 is manually lifted off of subplate 42 to lift the IC packages 14
12 from pins 60. Once stripper plate 50 is lifted off from pins 60, the
13 individual IC packages can be separated from stripper plate 50. An
14 exemplary method of removing the IC packages from stripper plate 50
15 is to tilt plate 50 and allow the packages to slide off plate 50. After
16 the packages 14 are removed, plate 50 can be returned to over 48 and
17 used again for separating IC packages.

18 Difficulties can occur in utilizing the assembly of Fig. 1 for
19 separating IC packages. For instance, separated IC packages can be
20 broken as stripper plate 50 is lifted from subplate 48. It would be
21 desirable to reduce or eliminate such problems.

22

23

1 SUMMARY OF THE INVENTION

2 In one aspect, the invention encompasses a method of forming
3 integrated circuit packages. A base having a plurality of pins extending
4 upwardly therefrom is provided. A support is provided over the base.
5 The support has an upper surface and a plurality of holes extending
6 therethrough. The pins extend through the holes and upwardly beyond
7 the upper surface of the support. An actuator is provided beneath the
8 support. A board having a plurality of integrated circuits bonded thereto
9 is provided. The integrated circuits form a repeating pattern of
10 integrated circuit packages across the board, and the board has a
11 plurality of holes extending through it. The board is placed over the
12 support upper surface with the pins extending into the holes in the
13 board. While the board is over the support upper surface, it is cut to
14 separate the integrated circuit packages from one another. After the
15 cutting, the support is vertically displaced by the actuator to lift the
16 support off the pins.

17 In another aspect, the invention encompasses an integrated circuit
18 package separator for separating integrated circuit packages from a board.
19 The board comprises a plurality of integrated circuits bonded thereto,
20 and has a plurality of holes extending within it. The separator includes
21 a base having a plurality of pins extending upwardly therefrom and a
22 support over the base. The support has an upper surface, a plurality
23 of holes extending therethrough, and a pair of opposing ends. The pins

1 extend through the holes in the support and upwardly beyond the upper
2 surface of the support. The support and pins are configured such that
3 the pins extend into the holes in the board when the board is placed
4 over the support upper planar surface. The separator further includes
5 a pair of actuators beneath the support and configured to vertically
6 displace the support and lift the support off the pins. Additionally, the
7 separator includes a cutting mechanism configured to cut the board while
8 the board is over the support upper planar surface and thereby separate
9 the integrated circuit packages from one another.

10

11 BRIEF DESCRIPTION OF THE DRAWINGS

12 Preferred embodiments of the invention are described below with
13 reference to the following accompanying drawings.

14 Fig. 1 is a diagrammatic, perspective, exploded view of a prior art
15 IC package separator and circuit board assembly.

16 Fig. 2 is a diagrammatic top view of an IC package separator of
17 the present invention.

18 Fig. 3 is a diagrammatic, perspective, exploded view of an IC
19 package separator of the present invention with a stripper plate of the
20 present invention and a circuit board.

21 Fig. 4 is a view of the Fig. 3 assembly with the circuit board
22 retained on the IC separator.

23

1 Fig. 5 is a view of the Fig. 4 assembly after the retained circuit
2 board is cut to separate individual IC packages from one another.

3 Fig. 6 is a view of the Fig. 5 assembly after a stripper plate is
4 lifted to release separated IC packages from retaining pins.

5

6 **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

7 This disclosure of the invention is submitted in furtherance of the
8 constitutional purposes of the U.S. Patent Laws "to promote the progress
9 of science and useful arts" (Article 1, Section 8).

10 An IC package separator of the present invention and a method
11 of operation of such separator are described below with reference to
12 Figs. 2-6. In referring to Figs. 2-6, similar numbering to that utilized
13 above in describing prior art Fig. 1 will be used, with differences
14 indicated by the suffix "a" or by different numerals.

15 Referring to Fig. 2, a separator 100 of the present invention is
16 shown in top view. Separator 100 comprises a table 44a and a
17 subplate 48a provided over table 44a. Table 44a can comprise, for
18 example, an x-y table similar to the table 44 described above with
19 reference to Fig. 1. Subplate 48a, like the above-described substrate 48
20 of Fig. 1, can be joined to table 44a through a plurality of downwardly
21 extending pins (not shown), and comprises a plurality of upwardly
22 extending pins 60 (only some of which are labeled) configured to retain
23 a circuit board assembly (not shown).

1 Subplate 48a differs from subplate 48 of Fig. 1 in that
2 subplate 48a comprises notches 102 at its ends. Notches 102 are
3 provided to allow room for a pair of forcer plates 104 and 106 to move
4 vertically (in and out of the page of Fig. 2) relative to table 48a.
5 Forcer plates 104 and 106 comprise upwardly extending pins 108
6 and 110, respectively. Base plate 48a comprises an upper planar
7 surface 115, and forcer plates 104 and 106 comprise upper planar
8 surfaces 117 and 119, respectively. Upper planar surfaces 115, 117
9 and 119 ultimately support a circuit board assembly (not shown in
10 Fig. 2). Planar surfaces 115, 117 and 119 are preferably substantially
11 coplanar with one another to avoid distorting (e.g., bending) a supported
12 circuit board assembly.

13 Forcer plates 104 and 106 are connected to actuators 112 and 114,
14 respectively, configured to vertically displace forcer plates 104 and 106.
15 In the exemplary shown embodiment, forcer plates 104 and 106 are
16 connected to the actuators with screws 116. It is to be understood,
17 however, that other mechanisms could be utilized for joining forcer
18 plates 104 and 106 to actuators 112 and 114, including, for example,
19 welding.

20 Actuators 112 and 114 are pneumatic (preferably air-powered) and
21 connected to a gas source 120. An advantage of utilizing air powered
22 actuators is that most wafer fabrication plants have a source of clean dry
23 air available. Accordingly, it is relatively convenient to couple air

1 powered actuators 112 and 114 into existing fabrication plants by simply
2 connecting them to existing air lines. However, it is to be understood
3 that the actuators can be powered by other sources besides air, including,
4 for example, other fluids, such as liquids, as well as non-pneumatic and
5 non-hydraulic sources, such as, for example, electricity.

6 Separator apparatus 100 comprises a cutting assembly (not shown
7 in Fig. 2) and a controller (not shown in Fig. 2), analogous to the
8 cutting assembly 42 and controller 45 of Fig. 1.

9 Referring to Fig. 3, IC circuit package separator 100 is shown in
10 exploded view with a circuit board assembly 10 identical to the assembly
11 described above with reference to Fig. 1.

12 A stripper plate 50a is provided between subplate 48a and circuit
13 board assembly 10. Stripper plate 50a is similar to the stripper plate 50
14 of Fig. 1 in that plate 50a comprises a plurality of orifices 62 configured
15 for receipt of pins 60. However, stripper plate 50a differs from plate 50
16 of Fig. 1 in that plate 50a also comprises orifices 122 configured for
17 receipt of upwardly extending pins 108 and 110 of forcer plates 104
18 and 106. Pins 108 and 110 are preferably tapered pins, such as can be
19 obtained from McMaster-Carr. Exemplary pins have a dimension
20 of 0.248 inches at base, 0.2324 inches at top, and a length of
21 0.75 inches. The taper of the pins can assist in aligning support 50a
22 over the pins during placement of support 50a onto base 48a.

23

1 Stripper plate 50a further differs from plate 50 of Fig. 1 in that
2 plate 50a is configured for receipt of a series of panels 132, 134
3 and 136. Stripper plate 50a can comprise, for example, static-reduced
4 plastic having a thickness of greater than 3/16 inches, and panels 132,
5 134 and 136 can comprise, for example, aluminum. In the shown
6 embodiment, panels 132, 134 and 136 are held to stripper plate 50a by
7 a plurality of screws 138 (only some of which are labeled). It will be
8 recognized, however, that other mechanisms can be utilized for holding
9 panels 132, 134 and 136 to stripper plate 50a, including riveting.
10 Alternatively, panels 132, 134 and 136 can be molded as part of stripper
11 plate 50a.

12 Panels 132, 134 and 136 comprise ribs 140, 142 and 144,
13 respectively (only some of which are labeled). Ribs 140, 142 and 144
14 can assist in supporting board assembly 10. Specifically, IC chips 12 are
15 frequently provided on both an upper surface of circuit board
16 assembly 10, and a bottom surface (not shown). Ribs 140, 142 and 144
17 (also referred to as blocks) have upper surfaces 141, 143 and 145,
18 respectively, which contact the bottom surfaces of circuit boards 11, 13
19 and 15 at locations between the IC chips 12 on the bottom of the
20 board. Preferably, such upper surfaces are provided at a height
21 approximately equal to a thickness of integrated circuit chip
22 components 12. Accordingly, when boards 11, 13 and 15 are rested on
23 panels 132, 134 and 136, respectively, the boards rest on the upper

1 surfaces of blocks 140, 142 and 144 while leaving integrated circuit chip
2 components on the underside of boards 11, 13 and 15 extending between
3 block upper surfaces 141, 143 and 145 and panels 132, 134 and 136.

4 An exemplary block height (or thickness) of blocks 140, 142 and 144 for
5 a DRAM having IC chips 12 with a TSOP dimensional package is 0.040
6 inches ± 0.005 inches. As another example, if IC chips 12 have a SOJ
7 dimensional package, the block height is preferably 0.140 inches ± 0.005
8 inches.

9 Blocks 140, 142 and 144 can be formed as one piece with panels
10 132, 134 and 136. Alternatively, blocks 140, 142 and 144 can be formed
11 as discrete pieces from panels 132, 134 and 136 that are subsequently
12 fastened to the panels.

13 In the shown embodiment, blocks 140, 142 and 144 are provided
14 in a one-to-one correspondence with integrated chip packages 14. Also,
15 in the shown exemplary embodiment each of panels 132, 134 and 136 is
16 identical to one another, and in a one-to-one correspondence with
17 individual boards 11, 13 and 15. It is to be understood, however, that
18 the invention encompasses other embodiments (not shown) wherein the
19 blocks are not provided in a one-to-one correspondence with
20 packages 14, wherein the panels are not identical to one another, and
21 wherein the panels are not in a one-to-one correspondence with the
22 individual boards.

23

1 Pins 60 extend upwardly beyond upper surfaces 141, 143 and 145
2 of blocks 140, 142 and 144, and are configured to retain circuit board
3 assembly 10 over stripper panel 50a. In the shown embodiment, pins 60
4 do not extend through panels 132, 134 and 136. However, it is to be
5 understood that the invention encompasses other embodiments wherein
6 pins 60 do extend through such panels.

7 Fig. 3 shows a side perspective view of actuator 112. In such
8 view it can be seen that several ports 150, 152, 153, 154, 155 and 156
9 are provided between actuator 112 and gas source 120. Valves (not
10 shown) are provided between source 120 and one or more of ports 150,
11 152, 153, 154, 155 and 156. Such valves enable fluid to be selectively
12 flowed from source 120 into one or more of ports 150, 152, 153, 154,
13 155 and 156 to selectively control raising and lowering of forcer
14 plate 104 with actuator 112. For instance, flow of gas into port 152 can
15 force a pneumatic cylinder to lift forcer plate 104, and flow of gas into
16 port 150 can force the pneumatic cylinder to lower forcer plate 104.

17 Ports 154 and 156 are connected to release valves 163 and 165,
18 respectively, which enable a pressure on at least one side of the
19 pneumatic cylinder of actuator 112 to be maintained at ambient pressure
20 (generally, about 1 atmosphere). Specifically, release valves 163 and 165
21 comprise outlet ports 157 and 159, respectively, which vent to a
22 surrounding environment. Persons of ordinary skill in the art will
23 recognize that one or more of ports 150, 157 and 159 are utilized as gas

1 outlet ports during lifting of forcer plate 104, and port 152 comprises
2 a gas inlet port during such lifting. In preferred embodiments of the
3 present invention, the release valves are associated with an outlet side
4 of actuator 112 to enable equilibration of a pressure at such outlet side
5 to ambient prior to (and/or during) lifting of forcer plate 104.
6 Specifically, the release valves enable gas to be drained from outlet lines
7 (more specifically, the gas is drained through ports 157 and 159 which
8 are open to ambient conditions) prior to, and/or during, lifting with the
9 actuator. Actuator 114 (Fig. 2) is preferably identical to actuator 112
10 and connected to an identical valve and port assembly as that shown
11 connected to actuator 112. Accordingly, actuator 114 is also connected
12 with release valves configured to equilibrate a back-pressure of the
13 actuator to ambient prior to, and/or during, lifting of stripper panel 50a.
14 The equilibration of pressure at the outlet ends of both of actuators 112
15 and 114 to ambient during a lifting operation can enable both actuators
16 to have an identical back-pressure during the lifting operation. This can
17 facilitate having both actuators lift simultaneously and in unison. Such
18 simultaneous lifting can avoid distortion (such as, for example, bending)
19 of circuit board assembly 10 during the lifting.

20 Stripper plate 50a has an upper planar surface 160 and a pair of
21 opposing ends 162 and 164. Opposing ends 162 and 164 overlie forcer
22 plates 104 and 106, respectively. In operation, actuators 112 and 114
23 are utilized to lift opposing ends 162 and 164 simultaneously and in

1 unison. Such can be accomplished by, for example, maintaining
2 approximately equal gas pressure at both of actuators 112 and 114 during
3 lifting, and is found to reduce breakage of integrated circuit packages
4 relative to prior art methods. The term "approximately" in the previous
5 sentence is utilized to indicate the gas pressure at both actuators is
6 equal within operational parameters.

7 A method of operation of separator 100 is described with reference
8 to Figs. 4-6. In referring to Figs. 4-6, subplate 48a is referred to as a
9 base, and stripper plate 50a is referred to as a support. Referring first
10 to Fig. 4, circuit board assembly 10 is shown retained on support 50a.
11 Specifically, circuit board assembly 10 is placed over support upper
12 surface 160 with pins 60 extending through orifices 19 of the circuit
13 boards 11, 13 and 15. Pins 60 and board assembly 10 are aligned such
14 that each of the integrated circuit packages 14 is retained to the
15 support 50a by at least one pin, and, in the shown embodiment, is
16 retained by 2 pins. In the Fig. 4 processing step, actuators 112 and 114
17 (Fig. 2) are in a lowered position.

18 Referring to Fig. 5, the individual integrated circuit packages 14
19 are separated from one another by cutting through boards 11, 13 and 15.

20 Referring to Fig. 6, actuators 112 and 114 (Fig. 2) are utilized to
21 vertically displace support 50a from base 48a. Preferably, such vertical
22 displacement comprises lifting both of ends 162 and 164 of support 50a
23 substantially simultaneously and substantially in unison with one another.

1 (As used in the preceding sentence, the term "substantially" indicates
2 that the lifting of both ends is simultaneous and in unison within
3 operational parameters.) In exemplary applications the upper surface 160
4 of support 50a is level prior to the lifting and remains level during the
5 lifting. The lifting of support 50a releases separated circuit packages 14
6 from pins 60. After such release, support 50a can be, for example,
7 manually lifted from pins 108 and 110, and the separated packages
8 removed from support 50a.

9 In compliance with the statute, the invention has been described
10 in language more or less specific as to structural and methodical
11 features. It is to be understood, however, that the invention is not
12 limited to the specific features shown and described, since the means
13 herein disclosed comprise preferred forms of putting the invention into
14 effect. The invention is, therefore, claimed in any of its forms or
15 modifications within the proper scope of the appended claims
16 appropriately interpreted in accordance with the doctrine of equivalents.

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1 **CLAIMS:**

2 1. An integrated circuit package separator for separating
3 integrated circuit packages from a board comprising a plurality of
4 integrated circuits bonded thereto, the board having a plurality of holes
5 extending within it, the separator comprising:

6 a base having a plurality of pins extending upwardly therefrom;

7 a support over the base and having an upper surface, the support
8 having a plurality of holes extending therethrough, the pins extending
9 through the holes and upwardly beyond the upper surface of the support;
10 the support and pins being configured such that the pins extend into the
11 holes in the board when the board is placed over the support upper
12 surface;

13 an actuator beneath the support and configured to vertically
14 displace the support and lift the support off the pins; and

15 a cutting mechanism configured to cut the board while the board
16 is over the support upper surface and thereby separate the integrated
17 circuit packages from one another.

18

19 2. The separator of claim 1 wherein the pins align with the
20 board such that each of the separated integrated circuit packages is
21 retained to the support by at least one pin.

1 3. The separator of claim 1 wherein the pins align with the
2 board such that each of the separated integrated circuit packages is
3 retained to the support by at least two pins.

4

5 4. The separator of claim 1 wherein the support is a sheet
6 comprising aluminum and having a thickness of at least 3/16 inches.

7

8 5. The separator of claim 1 wherein the actuator is
9 pneumatically powered.

10

11 6. The separator of claim 1 wherein the actuator is coupled to
12 the support through a lift member, the lift member having a substantially
13 planar upper surface and the base having a substantially planar upper
14 surface, the lift member substantially planar upper surface being
15 substantially flush with the base substantially planar upper surface.

16

17 7. The separator of claim 1 wherein the actuator is coupled to
18 the support through a lift member, the lift member having at least one
19 post extending upwardly therefrom, the at least one post extending
20 through a hole in the support.

1 8. The separator of claim 1 wherein the actuator is coupled to
2 the support through a lift member, the lift member having at least two
3 posts extending upwardly therefrom, the at least two posts extending
4 through holes in the support and aligning the support relative to the lift
5 member.

6
7 9. The separator of claim 1 wherein the actuator is
8 pneumatically powered; the actuator comprising a pair of gas ports, one
9 of the ports being a gas inlet when the actuator lifts the support and
10 the other port being a gas outlet when the actuator lifts the support;
11 the separator further comprising at least one pressure release valve in
12 fluid communication with the gas outlet.

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1 10. An integrated circuit package separator for separating
2 integrated circuit packages from a board comprising a plurality of
3 integrated circuits bonded thereto, the board having a plurality of holes
4 extending within it, the separator comprising:

5 a base having a plurality of pins extending upwardly therefrom;
6 a support over the base and having an planar surface, the support
7 having a plurality of holes extending therethrough and a pair of opposing
8 ends, the pins extending through the holes and upwardly beyond the
9 upper surface of the support; the support and pins being configured such
10 that the pins extend into the holes in the board when the board is
11 placed over the support upper surface;

12 a pair of actuators beneath the support and configured to vertically
13 displace the support and lift the support off the pins; and

14 a cutting mechanism configured to cut the board while the board
15 is over the support planar surface and thereby separate the integrated
16 circuit packages from one another.

17
18 11. The separator of claim 10 wherein the pins align with the
19 board such that each of the separated integrated circuit packages is
20 retained to the support by at least one pin.

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1 12. The separator of claim 10 wherein the pins align with the
2 board such that each of the separated integrated circuit packages is
3 retained to the support by at least two pins.

4

5 13. The separator of claim 10 wherein the actuators are
6 pneumatically powered.

7

8 14. The separator of claim 10 wherein the actuators are coupled
9 to the support through first and second lift members, respectively; the
10 lift members having substantially planar upper surfaces and the base
11 having a substantially planar upper surface, the substantially planar upper
12 surfaces of the lift members being substantially flush with the base
13 substantially planar upper surface.

14

15 15. The separator of claim 10 wherein the actuators are coupled
16 to the support through first and second lift members, respectively; at
17 least one of the lift members having at least one post extending
18 upwardly therefrom, the at least one post extending through a hole in
19 the support.

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1 16. The separator of claim 10 wherein the actuators are coupled
2 to the support through first and second lift members, respectively; the
3 first and second lift members each having at least one post extending
4 upwardly therefrom, the posts extending through holes in the support.

5
6 17. The separator of claim 10 wherein the actuators are coupled
7 to the support through first and second lift members, respectively; the
8 first and second lift members each having at least two posts extending
9 upwardly therefrom, the posts extending through holes in the support.

10
11 18. The separator of claim 17 wherein the posts are tapered, the
12 tapered posts being wider at the base than above the base.

13
14 19. The separator of claim 10 wherein the actuators are
15 pneumatically powered; the actuators each comprising a pair of gas ports,
16 one of each pair of ports being a gas inlet when the actuator lifts the
17 support and the other port of each pair of ports being a gas outlet
18 when the actuator lifts the support; the separator further comprising at
19 least one pressure release valve in fluid communication with the gas
20 outlets.

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1 20. The separator of claim 10 wherein the actuators are
2 pneumatically powered; the actuators each comprising a pair of gas ports,
3 one of each pair of ports being a gas inlet when the actuator lifts the
4 support and the other port of each pair of ports being a gas outlet
5 when the actuator lifts the support; the separator further comprising at
6 least two pressure release valves, one of the pressure release valves being
7 in fluid communication with one of the gas outlets, and an other of the
8 pressure release valves being in fluid communication with the other of
9 the gas outlets.

10
11 21. The separator of claim 10 wherein the actuators comprise a
12 first actuator proximate one of said opposing ends and a second actuator
13 proximate the other of said opposing ends.

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1 22. An integrated circuit package separator for separating a
2 plurality of integrated circuit packages from one another, the integrated
3 circuit packages being provided as integrated circuit chip components
4 joined to a board, the separating including cutting the board, the
5 separator comprising:

6 a panel;

7 a plurality of blocks over the panel, the blocks having upper
8 surfaces and being configured to support the board while leaving the
9 integrated circuit chip components extending between the block upper
10 surfaces and the panel; and

11 a cutting mechanism configured to cut the board while the board
12 is supported on the blocks and to thereby separate the integrated circuit
13 packages from one another.

14
15 23. The separator of claim 22 wherein the panel is fastened to
16 the support.

17
18 24. The separator of claim 22 wherein components have a
19 thickness and the blocks have a thickness about equal to that of the
20 components.

1 25. The separator of claim 22 wherein at least some of the
2 components have a common thickness and the blocks have a thickness
3 about equal to said common thickness.

4

5 26. The separator of claim 22 wherein the blocks are in a one-
6 to-one correspondence with the integrated circuit packages on the board.

7

8 27. The separator of claim 22 comprising more than one panel
9 over the support, each panel having blocks associated therewith.

10

11 28. The separator of claim 27 wherein the each of the panels
12 and blocks associated therewith is a panel and block assembly, the panel
13 and block assemblies all being identical to one another.

14

15 29. The separator of claim 22 wherein the blocks are fastened
16 to the panel.

17

18 30. The separator of claim 22 wherein the blocks are one-piece
19 with the panel.

1 31. The separator of claim 22 further comprising pins extending
2 upwardly from beneath the panel to beyond an upper surface of the
3 panel, the pins configured to extend into the board and retain the board
4 over the panel.

5
6 32. The separator of claim 31 wherein the pins do not extend
7 through the panel.

8
9 33. The separator of claim 31 further comprising an actuator
10 beneath the panel and configured to vertically displace the panel.

11
12 34. The separator of claim 33 wherein the actuator is
13 pneumatically powered.

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1 35. An integrated circuit package separator for separating
2 integrated circuit packages from a board comprising a plurality of
3 integrated circuit components bonded thereto, the components extending
4 outwardly from the board, the board having a plurality of holes
5 extending within it, the separator comprising:

6 a base having a plurality of pins extending upwardly therefrom;

7 a support over the base and having an upper planar surface, the
8 support having a plurality of holes extending therethrough and a pair of
9 opposing ends, the pins extending through the holes and upwardly
10 beyond the upper planar surface of the support; the support and pins
11 being configured such that the pins extend into the holes in the board
12 when the board is placed over the support upper planar surface;

13 a pair of actuators beneath the support and configured to vertically
14 displace the support and lift the support off the pins, the actuators
15 comprising a first actuator proximate one of said opposing ends and a
16 second actuator proximate the other of said opposing ends;

17 a panel over the support;

18 a plurality of blocks over the panel, the blocks having upper
19 surfaces and being configured to support the board while leaving the
20 integrated circuit chip components extending between the block upper
21 surfaces and the panel; and

22

23

1 a cutting mechanism configured to cut the board while the board
2 is over the panel and to thereby separate the integrated circuit packages
3 from one another.

4

5 36. The separator of claim 35 wherein the pins align with the
6 board such that each of the separated integrated circuit packages is
7 retained to the support by at least one pin.

8

9 37. The separator of claim 35 wherein the pins align with the
10 board such that each of the separated integrated circuit packages is
11 retained to the support by at least two pins.

12

13 38. The separator of claim 35 wherein the actuators are
14 pneumatically powered.

15

16 39. The separator of claim 35 wherein the actuators are coupled
17 to the support through first and second lift members, respectively; the
18 lift members having substantially planar upper surfaces and the base
19 having a substantially planar upper surface, the substantially planar upper
20 surfaces of the lift members being substantially flush with the base
21 substantially planar upper surface.

1 40. The separator of claim 35 wherein the actuators are coupled
2 to the support through first and second lift members, respectively; at
3 least one of the lift members having at least one post extending
4 upwardly therefrom, the at least one post extending through a hole in
5 the support.

6
7 41. The separator of claim 35 wherein the actuators are coupled
8 to the support through first and second lift members, respectively; the
9 first and second lift members each having at least two posts extending
10 upwardly therefrom, the posts extending through holes in the support.

11
12 42. The separator of claim 41 wherein the posts are tapered, the
13 tapered posts being wider at the base than above the base.

14
15 43. The separator of claim 35 wherein the actuators are
16 pneumatically powered; the actuators each comprising a pair of gas ports,
17 one of each pair of ports being a gas inlet when the actuator lifts the
18 support and the other port of each pair of ports being a gas outlet
19 when the actuator lifts the support; the separator further comprising at
20 least one pressure release valve in fluid communication with the gas
21 outlets.

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1 44. The separator of claim 35 wherein the actuators are
2 pneumatically powered; the actuators each comprising a pair of gas ports,
3 one of each pair of ports being a gas inlet when the actuator lifts the
4 support and the other port of each pair of ports being a gas outlet
5 when the actuator lifts the support; the separator further comprising at
6 least two pressure release valves, one of the pressure release valves being
7 in fluid communication with one of the gas outlets, and an other of the
8 pressure release valves being in fluid communication with the other of
9 the gas outlets.

10
11 45. The separator of claim 35 wherein the actuators comprise a
12 first actuator proximate one of said opposing ends and a second actuator
13 proximate the other of said opposing ends.

14
15 46. The separator of claim 35 wherein the panel is fastened to
16 the support.

17
18 47. The separator of claim 35 wherein the blocks are in a one-
19 to-one correspondence with the integrated circuit packages on the board.

20
21 48. The separator of claim 35 comprising more than one panel
22 over the support, each panel having blocks associated therewith.

1 49. The separator of claim 35 wherein the blocks are fastened
2 to the panel.

3
4 50. The separator of claim 35 wherein the blocks are one-piece
5 with the panel.

6
7 51. The separator of claim 35 wherein the pins do not extend
8 through the panel.

9
10 52. A method of forming integrated circuit packages, comprising:
11 providing a panel over a support;
12 providing a plurality of blocks extending upwardly from the panel,
13 the blocks having upper surfaces;
14 providing a board having a plurality of integrated circuit
15 components bonded thereto, the integrated circuit components extending
16 outwardly from the board and forming a plurality of integrated circuit
17 packages across the board;
18 placing the board over the panel, the block upper surfaces
19 supporting the board while leaving the integrated circuit components
20 extending between the block upper surfaces and the panel;
21 while the board is over the panel, cutting the board to separate
22 the integrated circuit packages from one another.

1 53. The method of claim 52 wherein the providing the panel
2 over the support comprises fastening the panel to the support.

3
4 54. The method of claim 52 wherein the blocks are provided in
5 a one-to-one correspondence with the integrated circuit packages.

6
7 55. The method of claim 52 comprising providing more than one
8 panel over the support, each panel having blocks associated therewith.

9
10 56. The method of claim 55 wherein the providing a board
11 comprises providing separate boards over the separate panels.

12
13 57. The method of claim 55 wherein the each of the panels and
14 blocks associated therewith is a panel and block assembly, the panel and
15 block assemblies all being identical to one another.

16
17 58. The method of claim 52 wherein the providing the blocks
18 comprises fastening the blocks to the panel.

19
20 59. The method of claim 52 wherein the blocks are one-piece
21 with the panel.

1 60. The method of claim 52 further comprising providing pins
2 extending upwardly from beneath the panel to beyond an upper surface
3 of the panel, the pins extending into the board to retain the board over
4 the panel.

5
6 61. The method of claim 60 wherein the pins do not extend
7 through the panel.

8
9 62. The method of claim 52 further comprising:
10 providing an actuator beneath the panel; and
11 after the cutting, vertically displacing the panel by the actuator.

12
13 63. The method of claim 52 further comprising:
14 providing pins extending upwardly from beneath the panel to
15 beyond an upper surface of the panel, the pins extending into the board
16 to retain the board over the panel;
17 providing an actuator beneath the panel; and
18 after the cutting, vertically displacing the panel by the actuator to
19 release the cut board from the pins.

1 64. The method of claim 52 further comprising:
2 providing pins extending upwardly from beneath the panel to
3 beyond an upper surface of the panel, the pins extending into the board
4 to retain the board over the panel, the pins and board aligning such
5 that each of the separated integrated circuit packages is retained to the
6 support by at least one pin;
7 providing an actuator beneath the panel; and
8 after the cutting, vertically displacing the panel by the actuator to
9 release the separated integrated circuit packages from the pins.

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1 65. A method of forming integrated circuit packages, comprising:
2 providing a base having a plurality of pins extending upwardly
3 therefrom;

4 providing a support over the base, the support having an upper
5 surface and a plurality of holes extending therethrough, the pins
6 extending through the holes and upwardly beyond the upper surface of
7 the support;

8 providing an actuator beneath the support;

9 providing a board having a plurality of integrated circuits bonded
10 thereto, the integrated circuits forming a plurality of integrated circuit
11 packages across the board, the board having a plurality of holes
12 extending therethrough;

13 placing the board over the support upper surface, the pins
14 extending into the holes in the board;

15 while the board is over the support upper surface, cutting the
16 board to separate the integrated circuit packages from one another; and

17 after the cutting, displacing the support by the actuator to lift the
18 support and cut board off the pins.

19
20 66. The method of claim 65 further comprising, after the
21 displacing, removing the separated integrated circuit packages from over
22 the support.

1 67. The method of claim 65 wherein the pins and board align
2 such that each of the separated integrated circuit packages is retained
3 to the support by at least one pin, the displacing releasing the separated
4 integrated circuit packages from the pins.

5
6 68. The method of claim 65 wherein the pins and board align
7 such that each of the separated integrated circuit packages is retained
8 to the support by at least two pins, the displacing releasing the separated
9 integrated circuit packages from the pins.

10
11 69. The method of claim 65 wherein the pins and board align
12 such that each of the separated integrated circuit packages is retained
13 to the support by at least one pin, the displacing releasing the separated
14 integrated circuit packages from the pins; the method further comprising,
15 after the displacing, removing the separated integrated circuit packages
16 from over the support.

17
18 70. The method of claim 65 wherein the actuator is
19 pneumatically powered and the displacing the support comprises forcing
20 gas into the actuator.

1 71. A method of forming integrated circuit packages, comprising:
2 providing a base having a plurality of pins extending upwardly
3 therefrom;

4 providing a support over the base, the support having an upper
5 planar surface and a pair of opposing ends, the support having a
6 plurality of holes extending therethrough, the holes aligning with the
7 pins, the pins extending through the holes and upwardly beyond the
8 upper planar surface of the support;

9 providing a pair of actuators beneath the support, a first of the
10 actuators being proximate one of the opposing ends and an other of the
11 actuators being proximate the other of the opposing ends;

12 providing a board having a plurality of integrated circuits bonded
13 thereto, the integrated circuits forming a repeating pattern of integrated
14 circuit packages across the board, the board having a plurality of holes
15 extending therethrough;

16 placing the board over the support upper planar surface, the pins
17 extending into the holes in the board;

18 while the board is over the support upper planar surface, cutting
19 the board to separate the integrated circuit packages from one another;
20 and

21 after the cutting, vertically displacing the support by the actuators
22 to lift the support off the pins, the vertically displacing comprising lifting
23 both ends of the support substantially simultaneously and substantially in

1 unison, the support upper planar surface remaining substantially level as
2 the support is lifted off the pins by the actuators.

3

4 72. The method of claim 71 wherein the actuators are
5 pneumatically powered and the vertically displacing the support comprises
6 forcing gas into the actuators.

7

8 73. The method of claim 71 wherein the actuators are
9 pneumatically powered and the vertically displacing the support comprises
10 forcing gas into the actuators; the substantially simultaneously and
11 substantially in unison lifting of the ends of the support comprising
12 forcing the gas into the individual actuators substantially simultaneously,
13 and maintaining a substantially equal gas pressure at both actuators
14 during the lifting.

15

16 74. The method of claim 71 wherein the actuators are
17 pneumatically powered and the vertically displacing the support comprises
18 forcing gas into the actuators; the forcing gas comprises flowing gas into
19 the actuators through inlet lines and out of the actuators through outlet
20 lines; and the method further comprising equilibrating gas in the outlet
21 lines with ambient pressure during the lifting.

1 75. The method of claim 71 wherein:
2 the actuators are pneumatically powered and the vertically
3 displacing the support comprises forcing gas into the actuators;
4 the forcing gas comprises flowing gas into the actuators through
5 inlet lines and out of the actuators through outlet lines;
6 the substantially simultaneously and substantially in unison lifting
7 of the ends of the support comprising forcing the gas into the individual
8 actuators substantially simultaneously, and maintaining a substantially
9 equal gas pressure at both actuators during the lifting; and
10 the maintaining a substantially equal gas pressure comprises
11 equilibrating gas in the outlet lines with ambient pressure during the
12 lifting.

13
14 76. The method of claim 71 further comprising, after the
15 vertically displacing, removing the separated integrated circuit packages
16 from over the support.

17
18 77. The method of claim 71 wherein the pins and board align
19 such that each of the separated integrated circuit packages is retained
20 to the support by at least one pin, the vertically displacing releasing the
21 separated integrated circuit packages from the pins.

1 78. A method of forming integrated circuit packages, comprising:
2 providing a base having a plurality of pins extending upwardly
3 therefrom;

4 providing a support over the base, the support having an upper
5 planar surface and a pair of opposing ends, the support having a
6 plurality of holes extending therethrough, the holes aligning with the
7 pins, the pins extending through the holes and upwardly beyond the
8 upper planar surface of the support;

9 providing a pair of actuators beneath the support, a first of the
10 actuators being proximate one of the opposing ends and an other of the
11 actuators being proximate the other of the opposing ends;

12 providing at least one panel over the support, the panel having a
13 plurality of blocks extending upwardly therefrom, the blocks having upper
14 surfaces;

15 providing a board having a plurality of integrated circuit
16 components bonded thereto, the integrated circuit components extending
17 outwardly from the board and forming a repeating pattern of integrated
18 circuit packages across the board, the board having a plurality of holes
19 extending therethrough;

20 placing the board over the panel, the pins extending into the holes
21 in the board, the block upper surfaces supporting the board while leaving
22 the integrated circuit components extending between the block upper
23 surfaces and the panel;

1 while the board is over the panel, cutting the board to separate
2 the integrated circuit packages from one another; and

3 after the cutting, vertically displacing the support by the actuators
4 to lift the support off the pins, the vertically displacing comprising lifting
5 both ends of the support substantially simultaneously and substantially in
6 unison, the support upper planar surface remaining substantially level as
7 the support is lifted off the pins by the actuators.

8

9 79. The method of claim 78 wherein the actuators are
10 pneumatically powered and the vertically displacing the support comprises
11 forcing gas into the actuators.

12

13 80. The method of claim 78 wherein the actuators are
14 pneumatically powered and the vertically displacing the support comprises
15 forcing gas into the actuators; the substantially simultaneously and
16 substantially in unison lifting of the ends of the support comprising
17 forcing the gas into the individual actuators substantially simultaneously,
18 and maintaining a substantially equal gas pressure at both actuators
19 during the lifting.

1 81. The method of claim 78 wherein the actuators are
2 pneumatically powered and the vertically displacing the support comprises
3 forcing gas into the actuators; the forcing gas comprises flowing gas into
4 the actuators through inlet lines and out of the actuators through outlet
5 lines; and the method further comprising equilibrating gas in the outlet
6 lines with ambient pressure during the lifting.

7

8 82. The method of claim 78 further comprising, after the
9 vertically displacing, removing the separated integrated circuit packages
10 from over the support.

11

12 83. The method of claim 78 wherein the pins and board align
13 such that each of the separated integrated circuit packages is retained
14 to the support by at least one pin, the vertically displacing releasing the
15 separated integrated circuit packages from the pins.

16

17 84. The method of claim 78 wherein the blocks are provided in
18 a one-to-one correspondence with the integrated circuit packages.

19

20 85. The method of claim 78 wherein the providing the blocks
21 comprises fastening the blocks to the panel.

22

23

1 86. The method of claim 78 wherein the blocks are one-piece
2 with the panel.

3
4 87. The method of claim 78 wherein the pins do not extend
5 through the panel.

6
7 88. The method of claim 78 comprising providing more than one
8 panel over the support, each panel having blocks associated therewith.

9
10 89. The method of claim 88 wherein the providing a board
11 comprises providing separate boards over the separate panels.

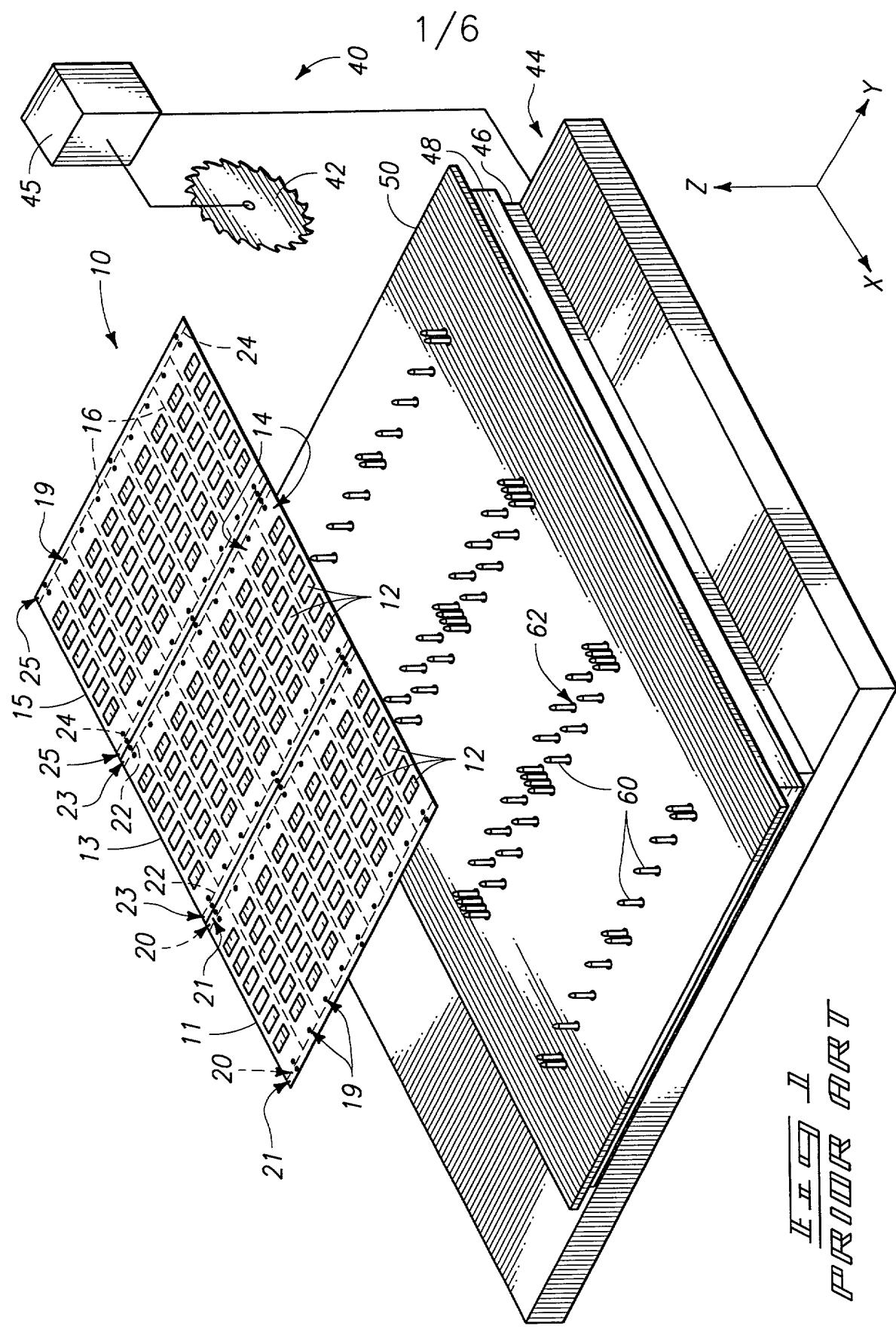
12
13 90. The method of claim 88 wherein the each of the panels and
14 blocks associated therewith is a panel and block assembly, the panel and
15 block assemblies all being identical to one another.

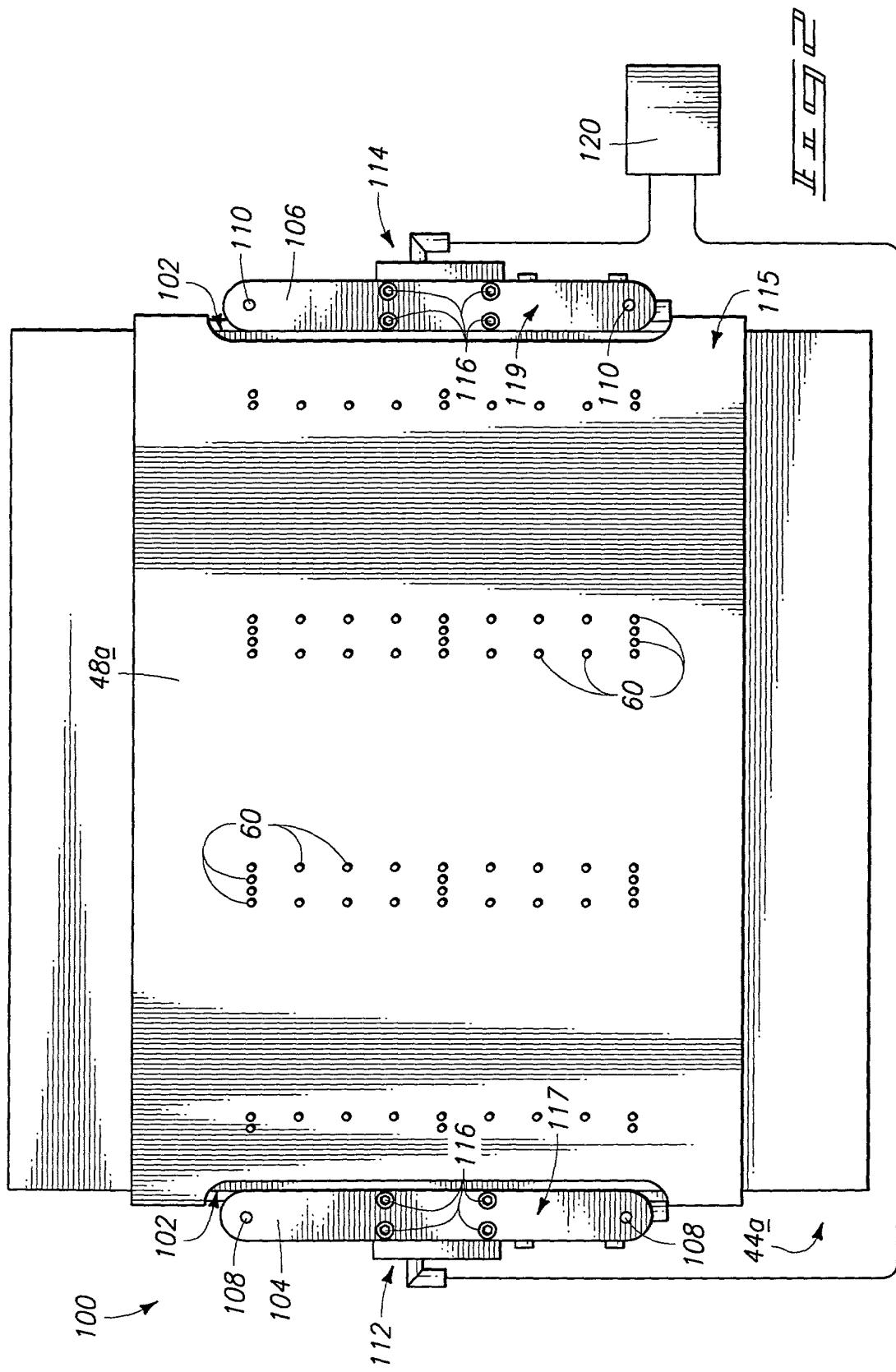
16
17 91. The method of claim 88 wherein the each of the panels and
18 blocks associated therewith is a panel and block assembly, the panel and
19 block assemblies all being identical to one another, and the blocks are
20 provided in a one-to-one correspondence with the integrated circuit
21 packages.

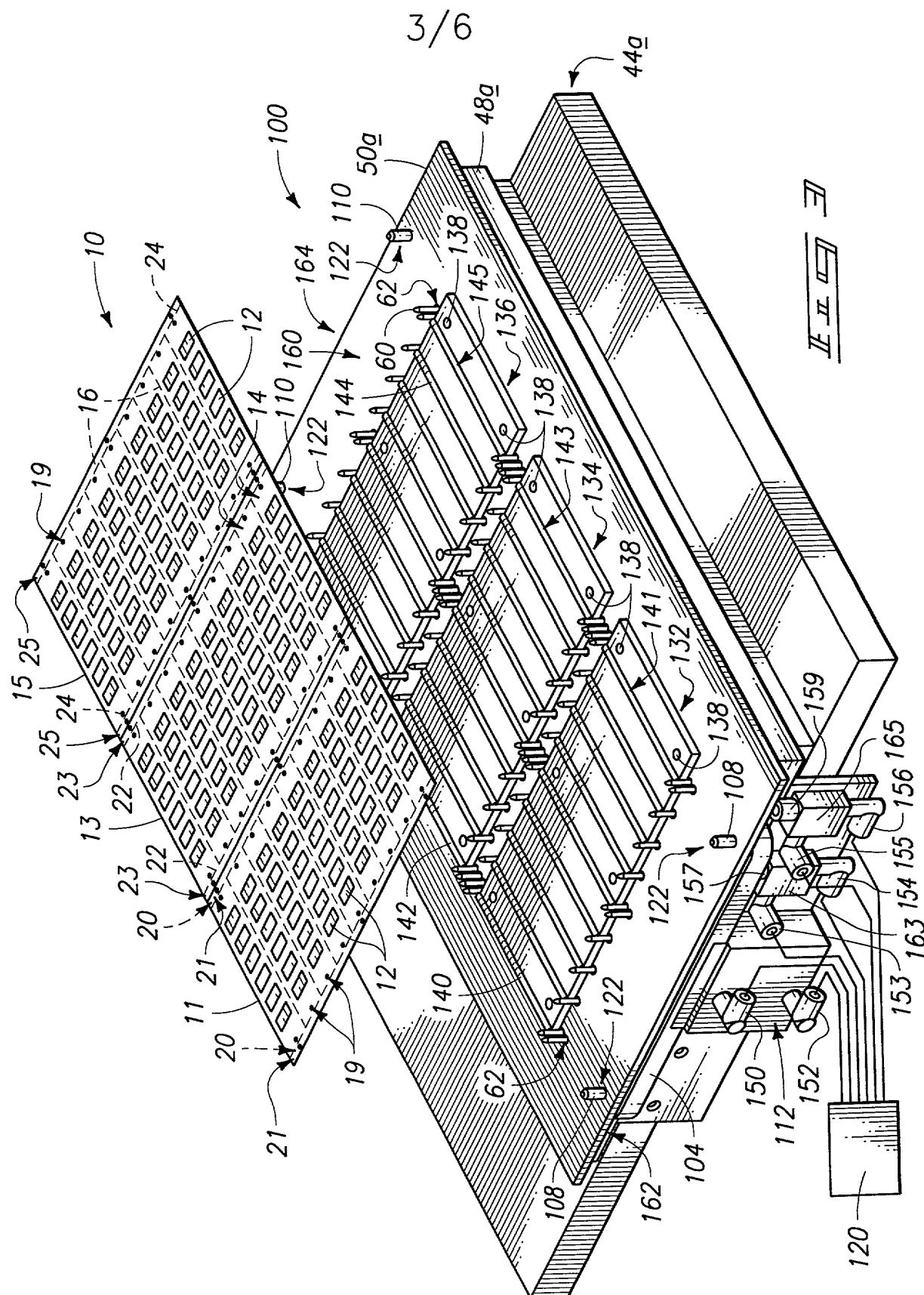
1 ABSTRACT OF THE DISCLOSURE

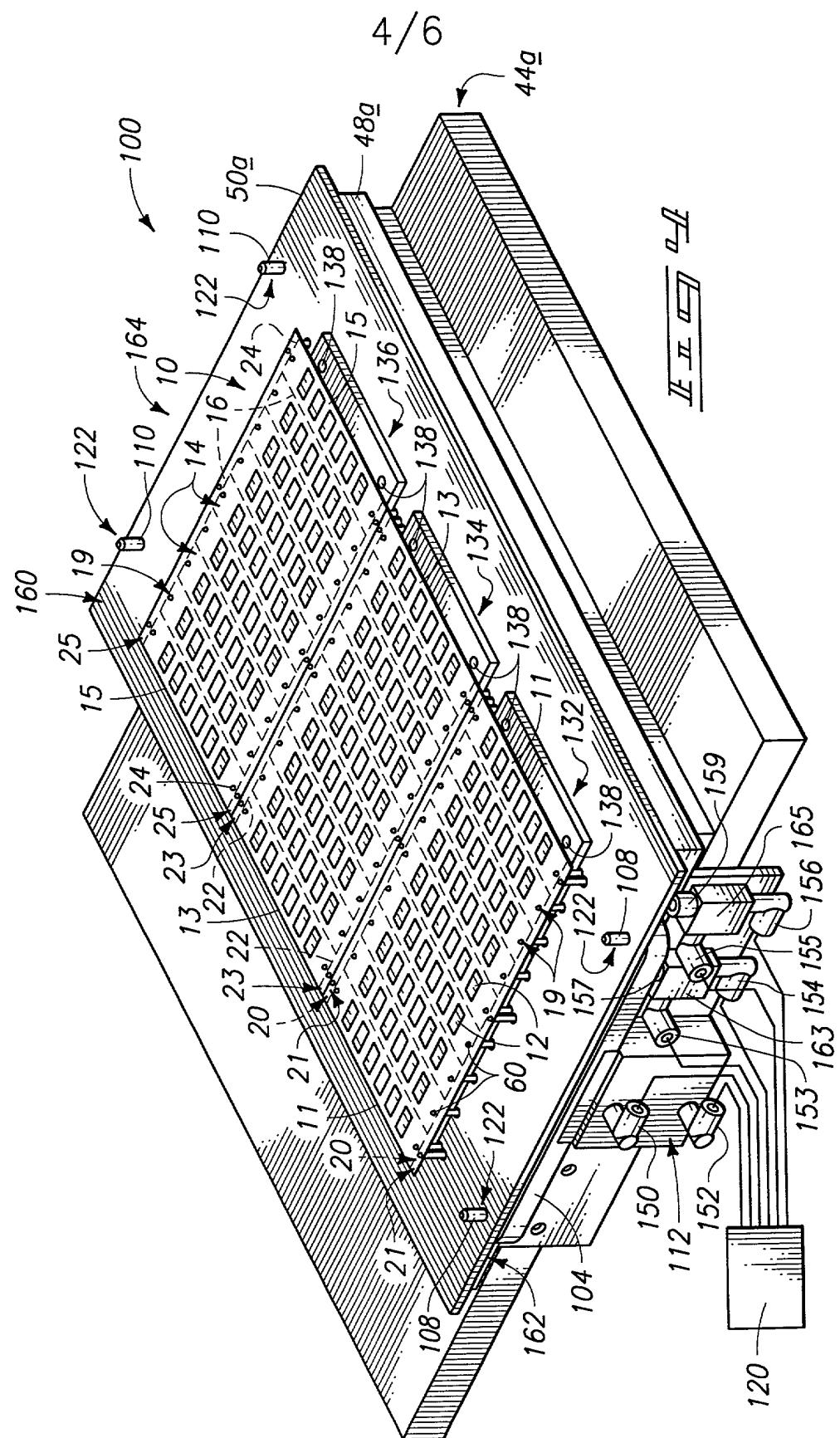
2 In one aspect, the invention includes a method of forming
3 integrated circuit packages. A base having a plurality of pins extending
4 upwardly therefrom is provided. A support is provided over the base.
5 The support has an upper surface and a plurality of holes extending
6 therethrough. The pins extend through the holes and upwardly beyond
7 the upper surface of the support. An actuator is provided beneath the
8 support. A board having a plurality of integrated circuits bonded thereto
9 is provided. The integrated circuits form a repeating pattern of
10 integrated circuit packages across the board, and the board has a
11 plurality of holes extending through it. The board is placed over the
12 support upper surface with the pins extending into the holes in the
13 board. While the board is over the support upper surface, it is cut to
14 separate the integrated circuit packages from one another. After the
15 cutting, the support is vertically displaced by the actuator to lift the
16 support off the pins.

17 In another aspect, the invention encompasses an integrated circuit
18 package separator for separating integrated circuit packages from a board.

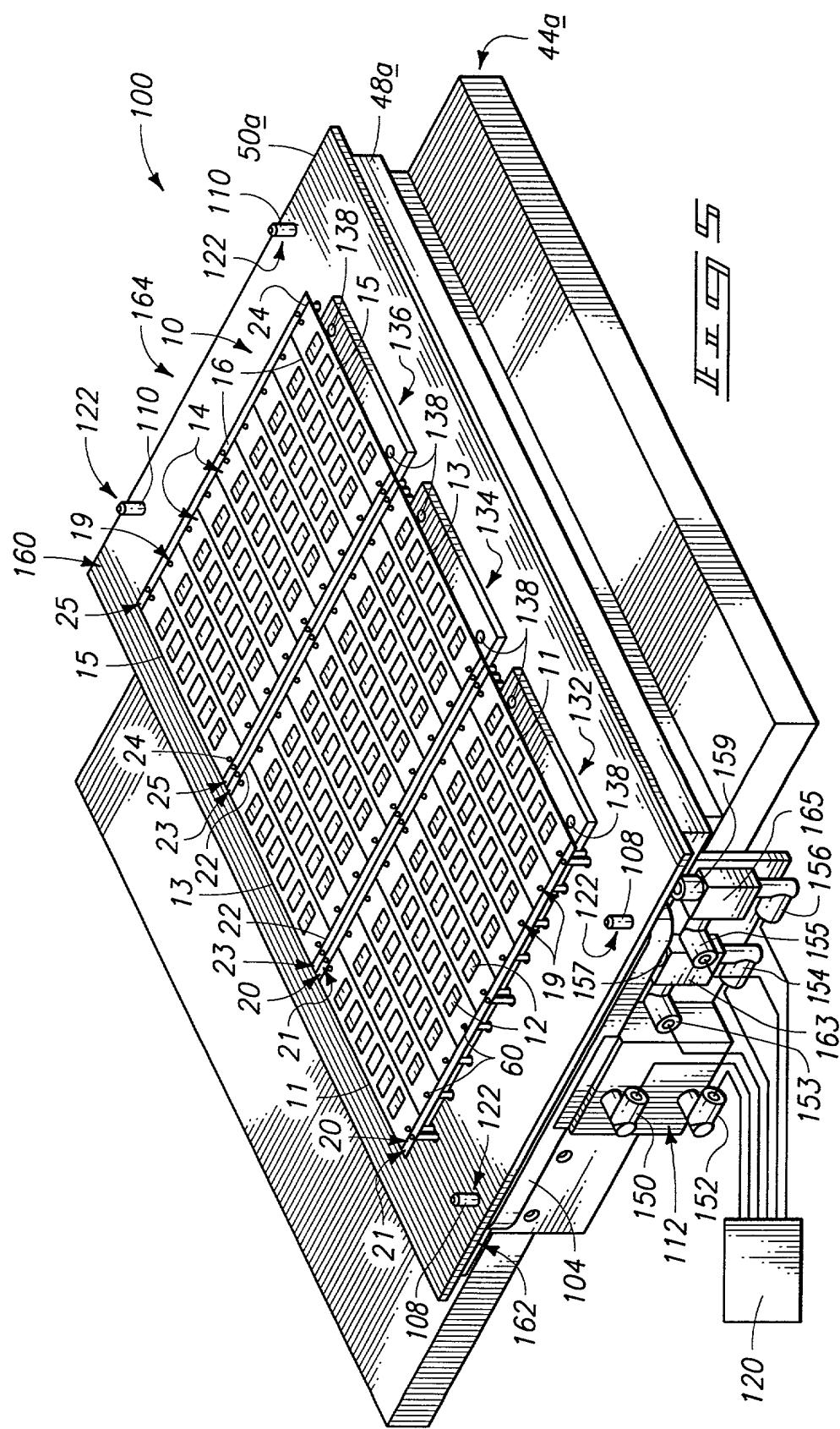


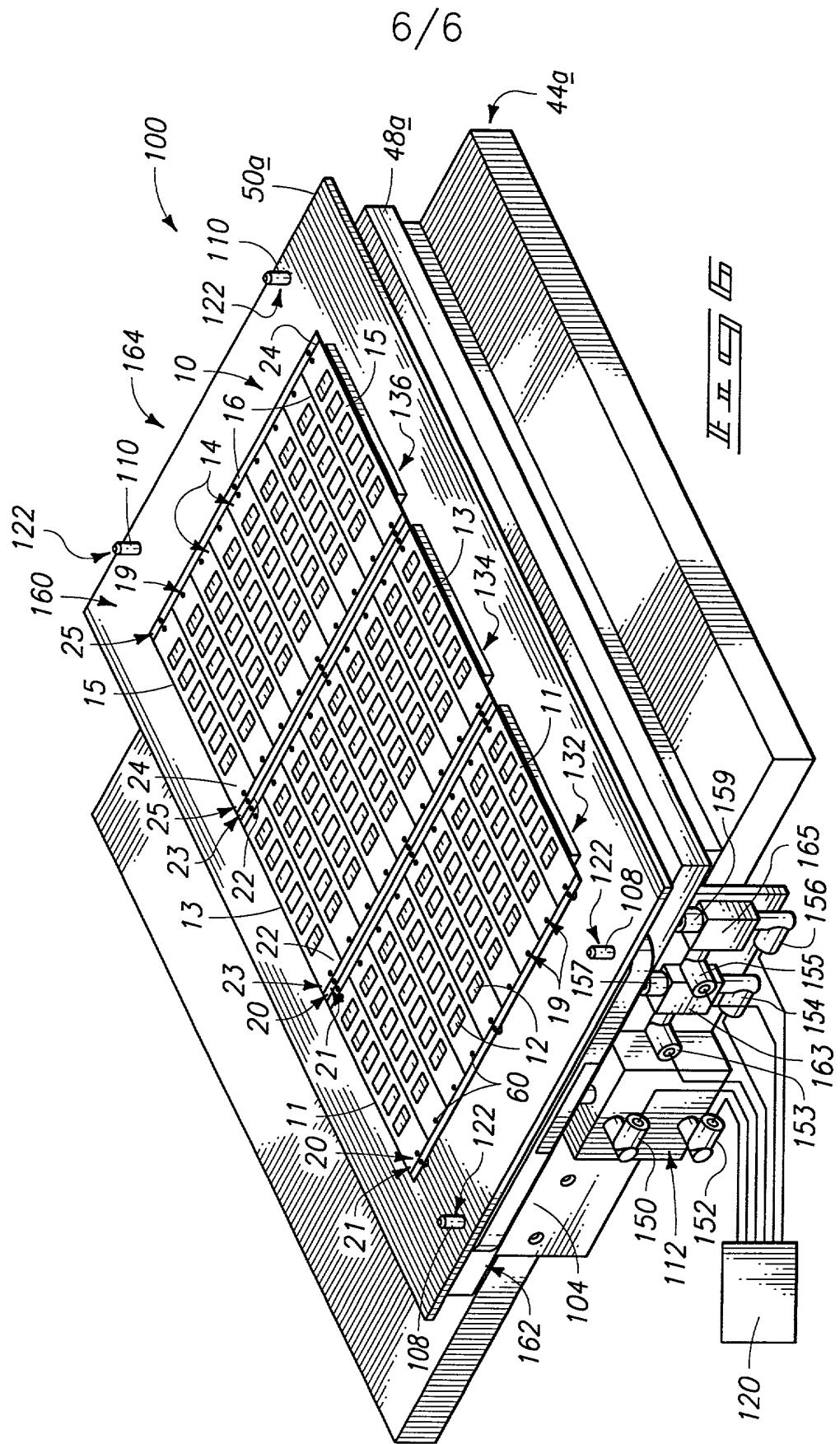






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DECLARATION OF SOLE INVENTOR FOR PATENT APPLICATION

As the below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled: Integrated Circuit Package Separators, And Methods Of Forming Integrated Circuit Packages, the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims.

I acknowledge the duty to disclose information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations §1.56.

PRIOR FOREIGN APPLICATIONS:

I hereby state that no applications for foreign patents or inventor's certificates have been filed prior to the date of execution of this declaration.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statement may jeopardize the validity of the application or any patent issued therefrom.

* * * * *

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